(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: 0 191 592
A2

EUROPEAN PATENT APPLICATION

(12) EUROPEAN PATENT APPLICATION

(21) Application number: 86300764.7

(22) Date of filing: 05.02.86

(51) Int. Cl.⁴: G 03 G 8/00, B 41 M 7/00

(30) Priority: 05.02.85 US 698241

(43) Date of publication of application: 20.08.86
Bulletin 86/34

(84) Designated Contracting States: AT BE CH DE FR GB IT LI LU NL SE

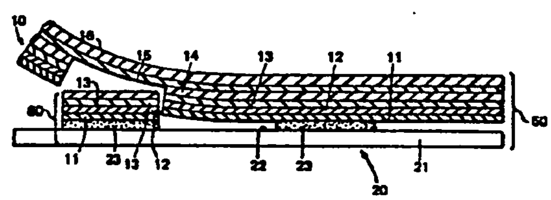
(71) Applicant: WOLSTENHOLME RINK PLC., Springfield Road, Sharples Bolton BL1 7LJ (GB)

(72) Inventor: Nelson, Marshall Aaron, P.O. Box 8, Lansing Illinois (US)

(74) Representative: McCall, John Douglas et al, W.P. THOMPSON & CO. Coopers Building Church Street, Liverpool L1 3AB (GB)

(54) **Process for selective transfer of metallic foils to xerographic images.**

(57) The present invention is directed to a method for selectively transferring metallic foil to xerographic images on a receiving substrate such as paper. The method generally comprises providing a transfer assembly including a metallic film and a receiving substrate including xerographic images disposed thereon. The receiving substrate is placed in face-to-face contact with the transfer assembly to form a sandwich with the xerographic images on the inside. The sandwich is then fed through an apparatus, where heat and pressure are applied, causing the xerographic images to tackify and causing the metal film from the transfer assembly to selectively adhere to the xerograhic images.



EP 0 191 592 A2

P039847E

0191592

DESCRIPTION

PROCESS FOR SELECTIVE TRANSFER OF METALLIC FOILS TO XEROGRAPHIC IMAGES

The present invention relates generally to the art of selective transfer processes, and specifically to the selective transfer of metallic foils to xerographic images.

The method for obtaining a copy of an original by electrostatic imaging is well known in the art, and is described in U.S. Patent Nos. 2,397,691 and 2,357,809 to Carlson. The method generally comprises:

(1) electrostatically charging a photosenstive plate;

(2) irradiating the plate with actinic radiation to dissipate the charge in exposed areas and form an electrostatic image in unexposed areas;

(3) dusting the plate with a pigmented resin powder carrying an opposite electrostatic charge to the charge of the electrostatic image, such that the powder is attracted and then attached to the image area;

(4) transferring the image from the plate to a copy sheet by mechanical or electrical means; and

(5) fixing the powdered image on the copy sheet by heat or chemical treatment.

Various patents have disclosed methods for obtaining color copies. For example, U.S. Patent No. 3,057,720 to Hayford et al. discloses a method for xerographic color reproduction, wherein the same general xerographic steps as outlined above are used in combination with the known "subtractive principle" of mixing primary colors, in a manner fully described in the '720 patent. U.S. Patent No. 3,088,402 to Newman discloses a method of producing an imaged hectograph master by superposing a transfer sheet coated with a transferable layer of dye-carrying composition upon a sheet including a xerographic image and heating the sheets to render the xerographic image tacky. The transfer sheet is then stripped from the resulting imaged hectograph master. Similarly, U.S. Patent No. 4,006,267 to Kurz, deceased, discloses placing a colored transfer donor in face-to-face contact with an image portion of a xerographic copy, heating the xerographic image, and removing the transfer donor to transfer the color of the donor layer to the image portion of the xerographic copy.

Methods for the selective transfer of metallic foils have also been disclosed. For example, U.S. Patent No. 4,053,344 to Hirahara discloses placing a stamping foil, having an adhesive on one side, over ink which is dried until tacky. The adhesive is of a type which reacts with and adheres to the ink but does not adhere to the article. U.S. Patent No. 3,519,512 to Downs similarly discloses using an ink-type "sensitizer" to adhere metallic foil to a substrate.

However, the process of selectively transferring metallic foils to a xerographic toner image is not specifically disclosed by the prior art.

A method is provided for forming images overlaid with metallic foil. According to the method of the present invention, a sheet comprising xerographic images is provided and placed in face-to-face contact with a foil transfer sheet, to form a sandwich with the xerographic images on the inside. Heat and pressure are applied to at least one of the sheet comprising xerographic images and the transfer sheet (and preferably to the sandwich), causing the zeographic images to become tacky and causing the foil (which is preferably metallic) to selectively adhere to the images. The remainder of the foil transfer sheet is then stripped away from the resulting decorated sheet comprising xerographic images overlaid with foil.

The heat is preferably applied at a temperature of from about 200 to about 375°F (more preferably about 350°F). The pressure is preferably applied in a range of from about 1 to about 20 pounds per square inch (more preferably at about 15 pounds per square inch).

By use of the present invention a quick and easy method of selectively coating the image portions of a substrate with metallic foil may be provided especially in the presently preferred embodiment, which involves passing the sandwich through heated rollers at a suitable temperature and pressure for transferring the foil to the xerographic images.

In a preferred embodiment the sandwich is passed between a pair of rollers, preferably at a rate of from about 100 to 500 inches per minute, more preferably at about 200 inches per minute.

The present invention will now be further described by way of example with reference to the accompanying drawings, in which:

FIGURE 1 shows a diagrammatic cross-sectional view of a color transfer sheet assembly and receiving substrate in use in a preferred embodiment of the present invention.

FIGURE 2 shows a diagrammatic perspective view of a transfer sheet assembly and receiving substrate for use in a second preferred embodiment of the present invention.

FIGURE 3 shows a diagrammatic cross-sectional view of the transfer sheet assembly and receiving substrate of FIG. 2 in use in a second preferred embodiment of the present invention.

FIGURES 4 through 8 show various apparatus with which the various embodiments of the present invention can be performed:

FIGURE 4 shows a diagrammatic cross-sectional view of a roller pair for use in accordance with an embodiment of the present invention.

FIGURE 5 shows a diagrammatic cross-sectional view of a roller pair and a pre-heating lamp for use in accordance with an embodiment of the present invention.

FIGURE 6 shows a diagrammatic cross-sectional view of a roller pair and a pre-heating oven for use in accordance with an embodiment of the present invention.

FIGURE 7 shows a diagrammatic cross-sectional view of a roller and platen pair for use in accordance with an embodiment of the present invention.

FIGURE 8 shows a diagrammatic cross-sectional view of a platen pair for use in accordance with an embodiment of the present invention.

FIG. 1shows a presently preferred transfer sheet assembly indicated generally as 10, and a receiving substrate, such as paper, indicated generally as 20. The transfer sheet assembly 10 of the preferred embodiment shown in FIG. 1 includes an adhesive 11, a primer 12, a metallic film 13, a clear or colored polymer coat 14, a release coat 15 and a carrier film 16. The receiving substrate 20

of this preferred embodiment comprises a sheet of paper 21 including an enamel treated surface 22 and xerographic images 23 thereon. For the purposes of this disclosure and the following claims, the term "xerographic images" is to be broadly construed to include clear or pigmented polymer powders deposited by the xerographic or other electrostatic image-forming processes. For example, such "xerographic images" might include polymer powders deposited by only the first four steps of the xerographic process described above while the fifth step may be omitted.

Alternate embodiments are contemplated in which various components shown in FIG. 1ı in FIG. 1 may be omitted or substituted. For example, the transfer sheet assembly 10 may be constructed to include only the metallic film 13 and the carrier film 16; likewise, the enamel treated surface 22 of the receiving substrate 20 may be omitted, with only an untreated sheet of paper 21 to be used instead. Moreover, the sheet of paper 21 may be substituted with any other sheet material capable of holding xerographic images while being non-adherent with respect to the adhesive 11 (or the metallic film 13, in the absence of any adhesive 11 or primer 12). For example, a polyester film treated with a high-melting acrylic primer (which has a softening point higher than that of the xerographic toner), can be substituted for the sheet of paper 21.

Accordingly, FIGS. 2 and 3 illustrate a much simplier transfer sheet product, indicated generally as 30, to be used in a second preferred embodiment of the invention. The transfer sheet product 30 of FIG. 3 includes a vacuum deposited metallic layer 31 disposed upon a clear or colored polymer film 32, such as, for example, an acrylic film like methyl methacrylate or a methacry-

late or a methacrylate copolymer, which is in turn disposed upon a polyester carrier 33. An adhesive layer 37 preferably coats the metallic layer 31 on the opposite side from the clear polymer film 32. The metallic layer 31, adhesive layer 37, polymer film 32 and the polyester carrier 33 together form a transfer sheet 34 that is adhered at an upper edge 35 to a backing sheet 36.

It should be noted that the transfer sheet assembly 10 or the transfer sheet product 30 can be provided with a backing sheet 36 as seen in FIGS. 2 and 3, in which case the receiving substrate is positioned in between the transfer sheet 34 and the backing sheet 36 (as expressly shown in FIG. 2), or in between the transfer sheet assembly 10 and a corresponding backing sheet (not shown in FIG. 1). Accordingly, the preferred embodiments illustrated by the drawings can be varied such that the transfer sheet assembly 10 is in the form of a roll (see, e.g., FIG. 4) or in individual sheet form as in FIGS. 2 and 3; and likewise, the transfer sheet product 30 of FIG. 3 can be provided in the form of a roll, without the backing sheet 36.

In use, the transfer sheet assembly 10 or the transfer sheet 34 is placed in face-to-face contact with the receiving substrate 20 to form a sandwich 50 with the xerographic images 23 on the inside, as seen in FIGS. 1 and 3. Heat and pressure are applied to the sandwich 50, causing the xerographic images 23 to become tacky and causing the metallic foil to selectively adhere to the images 23. The unadhered portion of the transfer sheet assembly 10 or the transfer sheet product 30 is then stripped away from the resulting decorated sheet 60 comprising the xerographic images 23 overlaid with the metal film 13 or the metallic layer 31.

Various means can be used to apply pressure and temperature in accordance with the present inven-

tion, examples of which are given in FIGS. 4 to 8. Each apparatus in the drawings includes a pair of elements for the application of pressure to the sandwich 50 (formed from the transfer sheet assembly 10 or the transfer sheet product 30, and the receiving substrate 20), and heating means which can be included in one of the pressure application elements and/or upstream the pair of pressure application elements. It is generally preferred that at least one of the pair of pressure application elements be formed of a resilient material at least at the area where contact is to be made with the transfer sheet assembly 10 or transfer sheet product 30, to ensure the desired conformity of opposing surfaces of the pair as the sandwich passes therethrough. The apparatus shown in FIG. 4 represents the presently preferred means for performing these pressure application and heating functions, and will be more fully discussed below. The apparatus shown in FIGS. 5 and 6 are similar to that shown in FIG. 4, but include pre-heating means upstream the pair of pressure application elements: FIG. 5 includes a heat lamp 73 and FIG. 6 includes an oven 74. Such preheating means can be used to pre-heat the entire sandwich 50 (i.e., the combined transfer sheet assembly 10 or product 30 and receiving substrate 20), or to simply pre-heat the receiving substrate 20. Embodiments including such pre-heating means are expected to be highly advantageous in that the rate of travel of the transfer sheet assemblies 10 or the transfer sheet products 30 will be increased, since it will not be necessary to maintain as great a dwell time in the pressure applying portions of the apparatus in order to achieve the desired temperature in the xerographic images.

In the presently preferred embodiment, the heat and pressure are applied by passing the sandwich 50 through a pair of rollers 70, as shown in FIGS. 4.

The pair of rollers 70 comprises a first roller 71, made, for example, from teflon coated aluminum, and a second roller 72, made, for example, from silicone rubber or having a silicone rubber surface. In this presently preferred embodiment, the first roller 71 is heated by heater 75 to a temperature in the range of from about 200 to about 375 degrees Fahrenheit, and most preferably a temperature of about 350 degrees Fahrenheit. The applied pressure is preferably in the range of from about 1 to about 20 pounds per square inch, and most preferably about 15 pounds per square inch. The pressure is applied to a contact area that is preferably of about .05 to about .3 square inches per inch of line contact, and most preferably about .15 square inches per inch of line contact. This contact area exists due to the slight flattening deformation of the silicone rubber roller 72, which has a hardness in the preferred range of from about 40 to about 80 durometers, and most preferably in the range of from about 50 to about 60 durometers. The presently preferred contact or dwell time is in the range of from about 0.01 to about 0.1 seconds, and most preferably is about 0.05 seconds, such that the sheet feed rate is preferably in the range of from about 100 to about 500 inches per minute, and most preferably approximately 200 inches per minute. For the purpose of the present invention, "dwell" or "contact" time is the period of time during which pressure is applied to the portion of the sandwich in contact with the pair of rollers 70 (or other pressure-applying element) to develop adhesion to the toner and effect transfer. These parameters have been developed in the presently preferred embodiments because of the excellent results they produce when used with the presently preferred transfer sheet assemblies 10 and transfer sheet products 30, each of which will now be described in detail.

The presently preferred embodiment of the transfer sheet assembly 10 includes each of the components shown in FIG. 1. The adhesive 11 in this embodiment is made from an acrylate copolymer containing a dispersion of finely divided silicon dioxide. Such a material can be obtained from Rohm & Haas of Philadelphia, Pennslyvania as ACRYLOID® B48N. The primer 12 is made from vinyl chloride / vinyl acetate / maleic acid copolymer. Such a material can be obtained from Union Carbide as UCAR® Grade UMCH. The metallic film 13 can be made from any of a variety of metals, such as aluminum, copper, chromium, tin, silver and gold, and the like, and in the preferred embodiment is made by vacuum deposition onto methyl methacrylate to a thickness preferably just approaching but not attaining optical opacity. Such vacuum deposited films can be obtained from Gomar Mfg. Co. of Linden, New Jersey. The presently preferred release coat 15 is made from an ethylene vinyl acetate copolymer. Such a material can be obtained from DuPont as ELVAX-40. Finally, the presently preferred carrier film 16 is made from polyester film (extruded and oriented polyethylene terephthalate, having a thickness in a range of 0.4 to 2 mils). Such a material can be obtained from ICI America as .5 mil type H film. The adhesive 11, and polymer coats 14 can be applied from an isopropyl acetate solution, while the primer 12 can be applied from a methyl ethyl ketone solution and the described release coat 15 can be applied from a toluol solution. An ideal composite film thickness (i.e., the combined thickness of all coating components except for the carrier film 16) has been found to be in the range of from about .02 mils to about .06 mils, and is optimally about .03 mils. Thicker composite films give decreased image resolution, while thinner composite films lose their integrity upon transfer and induce undesirable optical

effects.

It should be understood that the materials and details of construction of the foregoing detailed description are given only by way of illustration, and not limitation. These materials and details of construction can be varied to suit individual applications within the scope of this invention, as will be apparent to one of ordinary skill in the art. For example, the metal need not be vacuum deposited, but can be applied to a coating by the equivalent processes of silver reduction, organic solvent deposition, or the like. Moreover, the polymer coatings can be applied from water-based solutions or dispersions. Accordingly, it is intended that the following claims and all equivalents thereof, and not the foregoing detailed descriptions, be taken to define the scope of this invention.

....

CLAIMS

1. A selective transfer process characterised by the steps of:

providing a receiving substrate (20) comprising xerographic images (23) and a foil transfer sheet (10, 34);

placing the receiving substrate (20) comprising xerographic images (23) in face-to-face contact with the foil transfer sheet (10,34), to form a sandwich (50) with the xerographic images (23) on the inside;

applying heat and pressure to at least one of the receiving substrate (20) and the foil transfer sheet (10,34) to cause the xerographic image (23) to become tacky and the foil (13,31) to selectively adhere to the images (23), resulting in a decorated receiving substrate (60); and

stripping the foil transfer sheet (10,34) away from the decorated receiving substrate (60).

2. A process as claimed in claim 1, characterised in that the receiving substrate is a sheet.

3. A process as claimed in claim 1 or 2 in which said heat and pressure is applied to the sandwich.

4. A process as claimed in claim 1, 2 or 3, characterised in that the additional step of pre-heating the receiving substrate comprising xerographic images before the step of applying heat and pressure.

5. A process as claimed in any one of the preceding claims, characterised in that the heat is applied at a temperature in a range of from about 200 to about 375 degress Fahrenheit.

6. A process as claimed in any one of the preceding claims, characterised in that the pressure is applied in a range of from about 1 to about 20 pounds per square inch.

7. A process as claimed in any one of the preceding claims, characterised in that the foil transfer sheet (10,34) is made by vacuum depositing metal on a polymer backing.

8. A process as claimed in claim 7, characterised in that the metal is one of the group consisting of aluminum, copper, tin, silver and gold.

9. A process as claimed in any one of the preceding claims, characterised in that the foil transfer sheet (10,34) is attached to a backing sheet, and the receiving substrate comprising xerographic images is placed between the backing sheet and transfer sheet.

10. A process as claimed in any one of the preceding claims, characterised by the additional steps of:

providing a pair of rollers (71,72) adapted to apply heat and pressure to the sandwich (50); and

passing the sandwich (50) through the pair of rollers.

11. A process as claimed in claim 10 characterised by the additional step of providing a dwell time of about 0.01 to 0.1 seconds.

12. A process as claimed in claim 10 or 11, characterised in that the sandwich is passed through the rollers (71,72) at a rate of about 100 to about 500 inches per minute.

13. A process as claimed in any one of claims 10 to 12, characterised in that the pair of rollers (71, 72) comprises a rigid roller element (71) and a roller element (72) comprising a flexible surface.

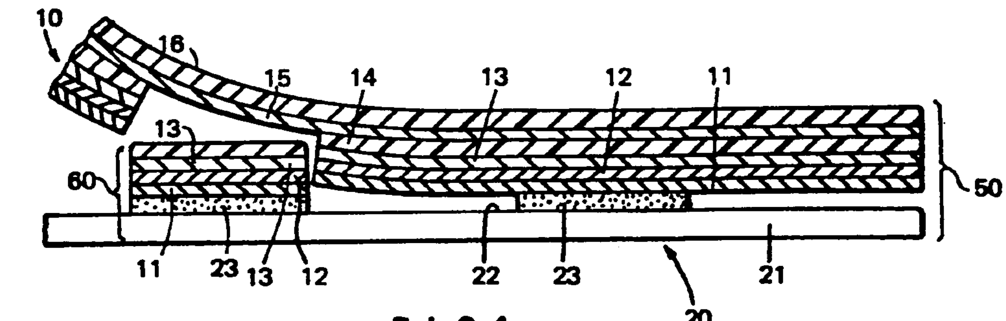
14. A process as claimed in claim 13 characterised in that the flexible element is constructed with a silicone rubber surface.

15. A process as claimed in claim 13 or 14, characterised in that the flexible roller element (72) has a surface hardness in a range of from about 40 durometers to about 80 durometers.

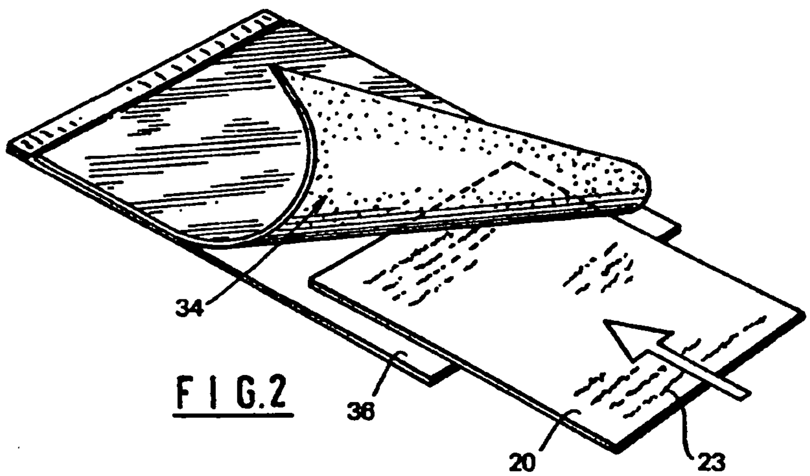
16. A process as claimed in any one of claims 10 to 15, characterised in that heat is applied to the sandwich simultaneously with the formation of contact between the sandwich and rollers.

17. A process as claimed in any of the preceding claims, characterised by the step of preheating the sandwich before applying the heat and pressure.

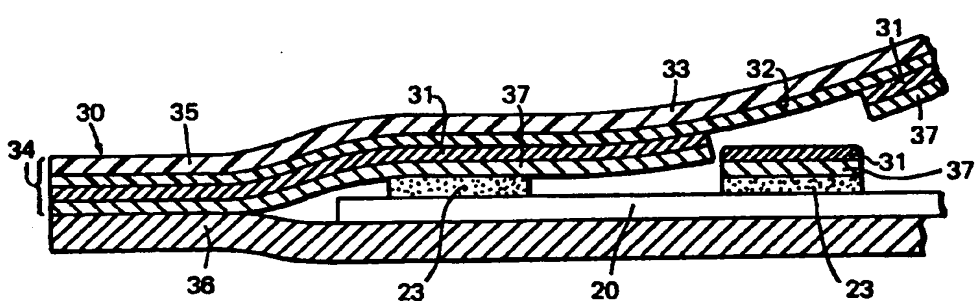
....



F I G.1



F I G.2



F I G.3

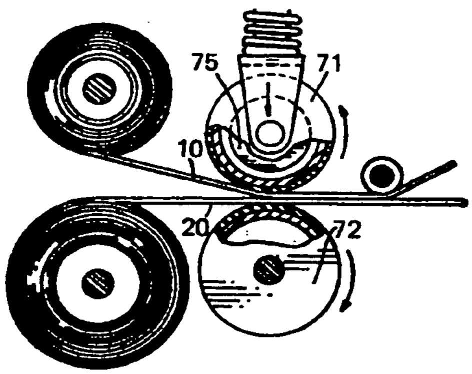


FIG.4

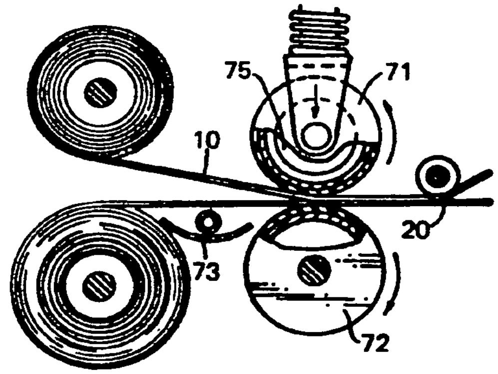


FIG.5

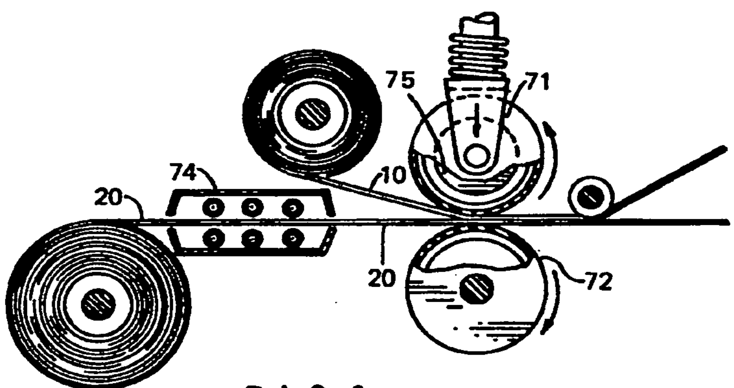


FIG 6

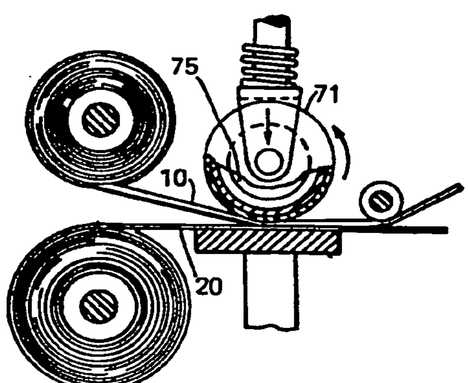


FIG.7

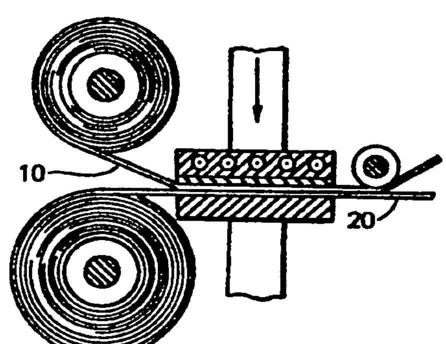


FIG.8